

**FUNCTIONAL COATINGS FOR THE REDUCTION OF OXYGEN PERMEATION AND  
STRESS AND METHOD OF FORMING THE SAME**

**Abstract of the Disclosure**

5        The oxidation behavior of the bond coat is improved using a HVOF  
nanostructured NiCrAlY coating. NiCrAlY powder is mechanically cryomilled and HVOF  
sprayed onto Ni-based alloy to form a nanocrystalline bond coat. Oxidation is  
performed on the coating to form the thermally grown oxide layer (thermally grown  
oxide). After heat treatment at 1000 °C for 24 and 95 hour, a homogeneous  $\alpha$ -Al<sub>2</sub>O<sub>3</sub>  
10 layer is formed on top of the bond coat. The nanostructured characteristic of the  
coating and the presence of Al<sub>2</sub>O<sub>3</sub> within the cryomilled powders (oxidation occurred  
during cryomilling process) affects the nucleation of the alumina layer on the top of the  
coating. The formation of a continuous thermally grown oxide layer protects the coating  
from further oxidation and avoids the formation of mixed oxide protrusions, such as  
15 those presented in the coating sprayed using the as-received powder.